

AMATEUR SATELLITE REPORT

AMSAT's Newsletter for the Amateur Space Program. (See last page for details)



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Interim Operating Schedule Put Into Effect

The new AO-10 operating schedule went into effect on 3 Sept. when DJ4ZC at Marburg loaded the new software to the spacecraft. The new schedule affects the Mode B and Mode L operating regimes. Similarly, it revises dramatically the program of events on the various beacons.

The new transponder schedule is being described as an interim measure designed to provide adequate safety margins while providing good service continuity to the user community. The interim operating schedule was required to compensate for a significant series of eclipses occurring each orbit throughout September and October. (See graphs in ASR -83). The maximum duration eclipse in this series is attained on or about 21 Sept. at which time AO-10 will be out of sunlight for 1.2 hours per orbit. This amounts to not less than a 10% reduction in available solar-derived energy. (Poor Sun-angle effects make the cumulative effect somewhat larger than the 10% reduction.) Beginning towards late October the eclipse duration will mitigate. DJ4ZC, in his text on both the General Beacon CW bulletin and in the PSK message blocks suggests a further schedule revision will occur in October. Presumably this will represent a schedule responsive to the improved eclipse situation.

The interim transponder operating schedule is as follows:

Mean Anomaly Start	Minutes Past Perigee	Mean Anomaly End (Inclusive)	Minutes Past Perigee (Inclusive)	Transponder Operating Mode	Episode Duration (Minutes)
32	87.5	99	270.7	B	183.2
100	270.7	116	317.2	L	46.5
117	317.2	189	516.8	B	199.6
190	516.8	255	699.5	Off	182.7
0	0	31	87.5	Off	87.5

Based on prior discussions, if a schedule revision in late October provides increased operating time, the period after mean anomaly 190 may be available. In the illustrative example shown in ASR #83, Mode B was extended through 218. Whether this can be achieved will depend on how well the spacecraft battery fares the eclipses. If the engineers have done their homework well, the battery will be in ex-

cellent shape. On the other hand, in the extremely unlikely event that a miscalculation has been made, the spacecraft could suffer irreparable damage to its primary battery. Thus caution is the watchword here.

The above schedule is for Monday through Saturday. On UTC Sundays, Mode B will replace Mode L such that Mode B will run continuously from 32 through 189.

The Beacon schedule revision is a long termed one; is not expected to be revised any time soon. The new Beacon schedule is responsive to the expressed desire of many to make better use of the Beacon facility. Consequently the new beacon schedule will contain much useful information such as Keplerian element sets by which one may calculate the satellite's accessibility. Moreover, an RTTY segment is now included in both the Mode B and Mode L



KA9Q addresses forum at the ARRL National Convention, New York, 21 July 84.

Beacon transmissions. The new Beacon schedule is as follows:

Minutes Past Hour	Beacon Mode
00-04	CW *
05-14	PSK
15-19	RTTY
20-29	PSK
30-34	CW *
35-44	PSK
45-49	RTTY
50-59	PSK

This is the Mode B Beacon (145.810 MHz) schedule. When Mode L is on (MA 100 - 116), the schedule will be the same except RTTY will be substituted for CW where denoted by "*". The Mode L Beacon is heard most often on the Engineering Beacon frequency, 436.04 MHz. CW is sent at approximately 13 wpm. RTTY is standard 170 Hz shift FSK at 50 baud. PSK is 400 baud ASCII.

There will be two separate CW bulletins sent. QTC001 is sent on the hour while QTC002 is sent on the half hour. The message on 3 Sept. was as follows (per JR1SWB):

HI HI DE AO10 QTC001 AT MA 219 AGC NO NEW OPERATING SCHEDULE IS EFFECTIVE OCT AND SEPT. TRANSPONDER IS ON BETWEEN 32 AND 190 MODE L EVERY DAY MA 100 TO 117 EXCEPT SUNDAY NORMAL OPERATION WILL RESUME AFTER ECLIPSE SEASON AO10 HI HI

HI HI DE AO10 QTC002 NEW BEACON OPERATIONS EFFECTIVE NOW ON THE HOUR. TEL AND QTC. ON THE HOUR PLUS 30. ORBITAL

ELEMENTS ON THE HOUR PLUS 15 AND 45. RTTY TEL AND QTC5 AO10 HI HI

Each RTTY bulletin will contain both CW bulletins text (QTC001 and 002) as well as telemetry data showing various spacecraft operating conditions. The parameters and their values will be published here soon. The RTTY bulletins will contain, specifically, the Z block (similar to the Y block of PSK telemetry), G block #1 (QTC001), another Z block and a final G block (QTC002). That is, the G blocks will be the same as the CW text except that LF/CR will be inserted.

ASE Software Update

AMSAT Software Exchange (ASE) Manager Bob Diersing, N5AHD, reports there is a bug in the IBM PC and Radio Shack TRS-80 Model III versions of the W3IWI orbital prediction program. Bob says it is an easy patch to make, however. Line 2020 reads as follows: 2020 IF K = K9 THEN 2040 : GOSUB 10110 : K8 = 9D9 : K9 = 9D9

The constants assigned to K8 and K9 might also appear as: K8 = 9000000000# : K9 = 9000000000#

The line should be changed to read: 2020 IF K = K9 THEN 2040 ELSE GOSUB 10110 : K8 = 9D9 : K9 = 9D9

Thus the only change is to substitute 'ELSE' for the colon in line 2020 between 2040 and GOSUB.

Bob explains that this bug lay latent for longer than most because it results in significant errors only after very long prediction runs (on the order of weeks). He credits Barry McLarnon, VE3KLW and others for bringing the bug to his attention.



N2CF addresses forum at the ARRL National Convention, New York, 20 July 84.



W5LFL addresses forum at the ARRL National Convention, New York, 20 July 84.



WA2LQQ at AMSAT Booth, ARRL National Convention, New York, 21 July 84.



The AMSAT booth at the ARRL National Convention, New York, 21 July 84. (l-r) K2UBC, WA2LJM, KA1M

Not Through Rose-Colored Glasses

Special To ASR
Opinion By Harold Price, NK6K
AMSAT Assistant Vice President, Engineering

Heard on Oscar 10 recently: "Well, I support the satellite, I pay my dues. Why don't we take a hard look at what Oscar 10 actually costs, per hour of use."

Let's look at that. We'll assume that, like a ground based repeater, its users must pay for its original installation and continuing costs. We all hope to get at least five good years out of OSCAR 10. We'll also assume we're getting 20 hours/day of communications time. That gives us 36,500 hours of communications time for the expected life of the spacecraft. There are about 150 kHz available for communications. Ignoring the complicating factor of CW (narrower bandwidth but much slower communication rates) there is room for 30 5 kHz wide voice channels. That gives 1,095,000 circuit hours to use as a basis to establish a 'charge rate' to recover the costs of installation. Various sources have placed the cost of 'installation' of OSCAR 10 (construction and launch) at \$240,000. To recover this cost on the basis of hours of use, each hour of use would cost \$0.21. To review: 5 years x 365 days/year x 20hr/day = 36500 hours 150 kHz / 5 kHz/channel = 30 channels 36500 hrs x 30 channels = 1,095,000 channel hours. \$240,000 / 1,095,000 ch-hr = \$0.21/ch-hr. This means an average user, using OSCAR 10 only 4 hours/week would have to pay \$43 a year to simply recover the cost of construction and launch, assuming the s/c was fully utilized. Now, as we know, we aren't getting 30 channels of use 20 hours/day. A better estimate would be 10 channels. As we have seen in the real world lately, if you use less of a fixed cost utility, the cost per use goes up. Without going thru all the calculations again, 1/3 the use means the cost per channel hour must be three times as great. The average user pays \$129.00/year. This figure does not include continued com-

mand cost, costs incurred by the ground telecommand network, the damage to mode L which is giving us a little less than 20 hours/day, or administrative costs such as selecting and announcing a new operations schedule. It most definitely does not include the construction and launch cost of a replacement for OSCAR 10. With these items thrown in, the average user, to support the current service and accumulate funds for a replacement should be donating about \$300.00 each year. Heavy users should send in more, especially those who are always louder than the beacon and those who pile up on DX. Obviously, we can't charge for the use of OSCAR 10. Just as obviously, we can't launch another one based on the support we're getting for this one. The AMSAT membership dues won't cover it. Not all of the users of satellites are members, and most of that money goes toward membership services, not new satellites. It's something to think about the next time you send off your yearly dues to your local repeater/autopatch group.



W3XO addresses the audience at the ARRL National Convention, New York, 20 July 84.

Orbit Predictions

By KA9Q

Satellite: OSCAR-9
Catalog number: 12888
Epoch time: 84245.38097269
Sat Sep 1 09:08:36.40 1984 UTC
Element set: 677
Inclination: 97.5988 deg
RA of node: 221.1855 deg
Eccentricity: 0.0002408
Arg of perigee: 164.0344 deg
Mean anomaly: 196.1002 deg
Mean motion: 15.26295495 rev/day
Decay rate: 1.913e-05 rev/day 2
Epoch rev: 16116
Semi major axis: 6862.000 km
Anom period: 94.346082 min
Apogee: 487.097 km
Perigee: 483.792 km
Ref perigee: 2435.41080159
Sat Sep 1 09:51:33.257 1984 UTC
Beacon: 145.8250 MHz

Satellite: OSCAR-10
Catalog number: 14129
Epoch time: 84245.97247851
Sat Sep 1 23:20:22.143 1984 UTC
Element set: 122
Inclination: 25.6768 deg
RA of node: 180.4720 deg
Eccentricity: 0.6066575
Arg of perigee: 302.6109 deg
Mean anomaly: 12.7882 deg
Mean motion: 2.05850089 rev/day
Decay rate: -9.1e-07 rev/day 2
Epoch rev: 919
Semi major axis: 26106.073 km
Anom period: 699.538196 min
Apogee: 35568.222 km
Perigee: 3893.332 km
Ref perigee: 2435.95522189
Sat Sep 1 22:55:31.170 1984 UTC
Beacon: 145.8100 MHz

Satellite: OSCAR-11
Catalog number: 14781
Epoch time: 84238.10950802
Sat Aug 25 02:37:41.492 1984 UTC
Element set: 40
Inclination: 98.2346 deg
RA of node: 300.0812 deg
Eccentricity: 0.0014750
Arg of perigee: 73.2178 deg
Mean anomaly: 287.0654 deg
Mean motion: 14.61895430 rev/day
Decay rate: 7.7e-07 rev/day 2
Epoch rev: 2577
Semi major axis: 7062.277 km
Anom period: 98.502257 min
Apogee: 713.749 km
Perigee: 692.915 km
Ref perigee: 2428.12336647
Sat Aug 25 02:57:38.863 1984 UTC
Beacon: 145.8260 MHz

Satellite: RS-3
Catalog number: 12997
Epoch time: 84245.00250300
Sat Sep 1 00:03:36.259 1984 UTC
Element set: 101
Inclination: 82.9566 deg
RA of node: 91.0443 deg
Eccentricity: 0.0058038
Arg of perigee: 188.5482 deg
Mean anomaly: 171.4626 deg
Mean motion: 12.15588021 rev/day
Decay rate: 4e-08 rev/day 2
Epoch rev: 12014
Semi major axis: 7987.327 km
Anom period: 118.461187 min
Apogee: 1656.004 km
Perigee: 1563.291 km
Ref perigee: 2434.96332155
Fri Aug 31 23:07:10.982 1984 UTC

Satellite: RS-4
Catalog number: 13000
Epoch time: 84242.60334243
Wed Aug 29 14:28:48.785 1984 UTC
Element set: 216
Inclination: 82.9593 deg
RA of node: 101.8481 deg
Eccentricity: 0.0017274
Arg of perigee: 283.4061 deg
Mean anomaly: 76.4961 deg
Mean motion: 12.06667459 rev/day
Decay rate: 0 rev/day 2
Epoch rev: 11894
Semi major axis: 8026.669 km
Anom period: 119.336938 min
Apogee: 1682.321 km
Perigee: 1654.590 km
Ref perigee: 2432.58573284
Wed Aug 29 14:03:27.317 1984 UTC

Satellite: RS-5
Catalog number: 12999
Epoch time: 84239.02868601
Sun Aug 26 00:41:18.471 1984 UTC
Element set: 186
Inclination: 82.9592 deg
RA of node: 105.3413 deg
Eccentricity: 0.0010404
Arg of perigee: 321.1777 deg
Mean anomaly: 38.8554 deg
Mean motion: 12.05058074 rev/day
Decay rate: 3e-08 rev/day 2
Epoch rev: 11835
Semi major axis: 8033.819 km
Anom period: 119.496316 min
Apogee: 1672.311 km
Perigee: 1655.594 km
Ref perigee: 2429.01972946
Sun Aug 26 00:28:24.625 1984 UTC

Satellite: RS-6
Catalog number: 13002
Epoch time: 84247.06383140
Mon Sep 3 01:31:55.32 1984 UTC
Element set: 87
Inclination: 82.9569 deg
RA of node: 92.0551 deg
Eccentricity: 0.0049459
Arg of perigee: 203.3380 deg
Mean anomaly: 156.5438 deg
Mean motion: 12.13562715 rev/day
Decay rate: 4e-08 rev/day 2
Epoch rev: 12016
Semi major axis: 7996.217 km
Anom period: 118.658886 min
Apogee: 1660.926 km
Perigee: 1581.829 km
Ref perigee: 2437.02799939
Mon Sep 3 00:40:19.147 1984 UTC

Satellite: RS-7
Catalog number: 13001
Epoch time: 84245.10146566
Sat Sep 1 02:26:06.633 1984 UTC
Element set: 170
Inclination: 82.9569 deg
RA of node: 98.1893 deg
Eccentricity: 0.0021026
Arg of perigee: 233.9609 deg
Mean anomaly: 125.9506 deg
Mean motion: 12.08686173 rev/day
Decay rate: 4e-08 rev/day 2
Epoch rev: 11944
Semi major axis: 8017.724 km
Anom period: 119.137625 min
Apogee: 1670.210 km
Perigee: 1636.494 km
Ref perigee: 2435.07251995
Sat Sep 1 01:44:25.723 1984 UTC

Satellite: RS-8
Catalog number: 12998
Epoch time: 84246.07306059
Sun Sep 2 01:45:12.434 1984 UTC
Element set: 289
Inclination: 82.9585 deg
RA of node: 103.6099 deg
Eccentricity: 0.0019660
Arg of perigee: 359.3119 deg
Mean anomaly: 0.7907 deg
Mean motion: 12.02947164 rev/day
Decay rate: 4e-08 rev/day 2
Epoch rev: 11899
Semi major axis: 8043.221 km
Anom period: 119.706006 min
Apogee: 1680.892 km
Perigee: 1649.266 km
Ref perigee: 2436.07287801
Sun Sep 2 01:44:56.659 1984 UTC

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